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cess of births over deaths, and the infant-mortality rate. Figures for the white and colored

EXCESS OF BIRTHS OVER DEATHS, AND INFANT MORTALITY: 1916

Area	Number of Births	Excess of Births Over Deaths (Per Cent.)	Deaths of Infants Under 1 Year of Age per 1,000 Living Births
Registration area. . . .	818,983	68.7	101
<i>Registration states</i>			
Connecticut . . . . .	35,351	74.2	101
Maine . . . . .	16,033	32.5	108
Maryland, total: . . . .	33,631	49.7	121
White . . . . .	27,305	63.9	101
Colored . . . . .	6,326	6.0	209
Massachusetts . . . . .	93,497	65.1	100
Michigan . . . . .	86,840	88.1	96
Minnesota . . . . .	55,459	127.1	70
New Hampshire. . . . .	9,664	35.4	115
New York . . . . .	241,456	58.8	94
Pennsylvania . . . . .	217,449	74.7	114
Rhode Island . . . . .	14,634	53.5	111
Vermont . . . . .	7,768	37.2	93
<i>Registration cities having more than 100,000 inhabitants in 1910</i>			
Connecticut:			
Bridgeport . . . . .	4,598	94.8	106
New Haven . . . . .	5,106	100.6	88
Maryland:			
Baltimore, total. . . .	14,542	36.5	122
White . . . . .	12,278	54.1	104
Colored . . . . .	2,264	-16.6 <sup>1</sup>	219
Massachusetts:			
Boston . . . . .	19,577	53.3	105
Cambridge . . . . .	2,691	76.3	91
Fall River . . . . .	3,689	68.8	173
Lowell . . . . .	3,287	67.6	146
Worcester . . . . .	4,941	70.2	101
Michigan:			
Detroit . . . . .	24,289	121.6	112
Grand Rapids . . . . .	3,131	100.0	75
Minnesota:			
Minneapolis . . . . .	8,793	95.2	82
St. Paul . . . . .	5,242	87.6	68
New York:			
Albany . . . . .	2,280	11.4	97
Buffalo . . . . .	13,088	73.3	114
New York . . . . .	137,923	77.0	93
Rochester . . . . .	6,816	82.6	86
Syracuse . . . . .	3,853	63.2	100
Pennsylvania:			
Philadelphia . . . . .	40,360	45.7	105
Pittsburgh . . . . .	16,406	62.6	115
Scranton . . . . .	3,623	71.5	131
Rhode Island:			
Providence . . . . .	5,981	48.7	110
District of Columbia:			
Washington, total. . .	7,201	11.2	106
White . . . . .	4,979	25.3	83
Colored . . . . .	2,222	-12.2 <sup>1</sup>	158

<sup>1</sup> Per cent. by which births fell below deaths.

elements of the population are shown separately for those areas in which colored persons constitute more than one tenth of the total population.

## SPECIAL ARTICLES

### NOTE UPON THE HYDROGEN ION CONCENTRATION NECESSARY TO INHIBIT THE GROWTH OF FOUR WOOD-DESTROYING FUNGI<sup>1</sup>

THE importance of hydrogen (and hydroxyl) ion concentration as a factor in physico-chemical and biochemical studies of living organisms is being recognized. A careful study of this factor has not been made heretofore due largely to the lack of ready means for making the determinations. The indicator method was not seriously developed until about a decade or so ago, and the hydrogen electrode was not applied to such problems until recently, due partly, undoubtedly, to the fact that biologists did not realize its possibilities.

Consequently no exact information is at hand concerning the behavior of fungi, in general, toward varying degrees of hydrogen ion concentration. This remark applies especially to wood-destroying fungi. Information which is available is usually given in a rather vague manner with the use of such terms as "alkaline," "slightly acid," "strongly acid" or as percentage of acid (or base) added.

The expression, P, is now widely used as a means of stating hydrogen (or hydroxyl) ion concentration. The term is used and explained in the literature sufficiently often to make its explanation here unnecessary.

The four fungi studied in this investigation are: *Lenzite sepiaria*, *Fomes roseus*, *Coniophora cerebella* and *Merulius lachrymans*. Synthetic and malt extract media were used. The data obtained showed that their growth is not inhibited until a surprisingly

<sup>1</sup> This note is a brief statement of the results presented in a paper on the same subject in partial fulfillment of the requirements for the degree of Ph.D. at the New York State College of Forestry at Syracuse University. A considerable part of the work was done in the office of Forest Pathology, Bureau of Plant Industry, at the Forest Products Laboratory, Madison, Wis. Detailed data will be published soon.

high hydrogen ion concentration is reached, and furthermore, that these four organisms respond in about the same way, though there are distinct variations among them. Furthermore, as might be expected, the curves obtained are similar to those showing the relation between enzyme activity and hydrogen ion concentration.

The most important facts to be presented here can be shown by means of a general curve setting forth the general behavior of the four fungi studied. The curve shown in the accompanying figure is constructed by plotting as ordinates the weights in grams of mycelium, produced in about five weeks' time upon media of varying  $P_H$  values as represented by the abscissae. This curve shows in a very general way the mean of the individual curves for the different fungi when grown upon the two media. The weight of mycelium produced shows large variation among the individual curves while there is rather close agreement in the  $P_H$  values which are physiologically important to the various fungi.

In the following discussion we shall speak of the "first critical point," meaning the  $P_H$  at *B* (figure), the point where the first marked deflection in the growth curve appears; the "second critical point," meaning the  $P_H$  at *C*, where the second marked deflection in the growth curve occurs in the opposite sense; and the "limiting acidity," meaning the  $P_H$  at *D*, where practically no growth occurs. By "critical range" we shall mean the range of the  $P_H$  values included between the first and the second critical points.

The curve in the accompanying figure is drawn with the portion *AB* horizontal. In the individual curves—that is for a single fungus on a single medium—this part may be horizontal or may slope either up or down in passing toward *B*. Or again, in passing from *A* toward *B* the curve may rise to a maximum and then fall toward the critical point *B* where a sharp inflection downward occurs. Such a maximum, when present, usually occurs nearer *B* than *A*—that is, at a  $P_H$  of about 3.0. The critical points stand out more sharply in some than in other curves and the first critical

point is usually more pronounced than the second critical point. The slope between *B* and *C* shows a rather large variation in the

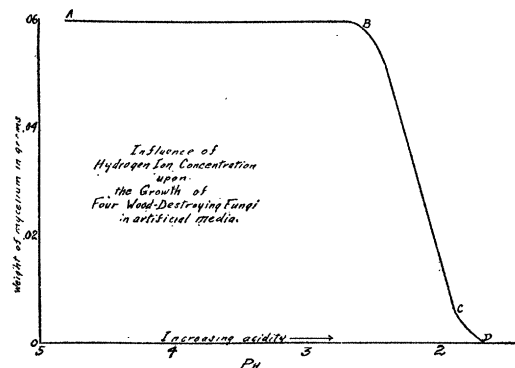


FIG. 1.

individual curves. In some cases the line between these two points is nearly vertical. In this curve the point *D* appears as a rather abrupt point. Point *C* often occurs nearer the lower axis and the portion of the curve *CD* occurs more nearly horizontal with a more or less uncertain termination. However, the limiting  $P_H$  value appears to be in the region of 1.7.

Translating these data into terms of normality, the first critical point occurs at about 1/350 normal, and the limiting acidity at about 1/50 normal, hydrogen ion concentration.

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